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(54) Abstract Title

PC card integrated communication apparatus and battery charger

(57) A PCMCIA type computer card C has a battery C3, radio communication circuitry C1 and modem C21a. The battery if detected c115 as being present is provided with a means c110 to charge the battery from the PC when the radio communication circuitry is operating at a reduced level. In the event that the battery is not connected the communication circuitry cannot be powered up as is controlled by a power supply controller. The voltage detecting circuit C26a is used to detect if the card is inserted into personal computer and to power down the circuitry if it is disconnected.

FIG. 1

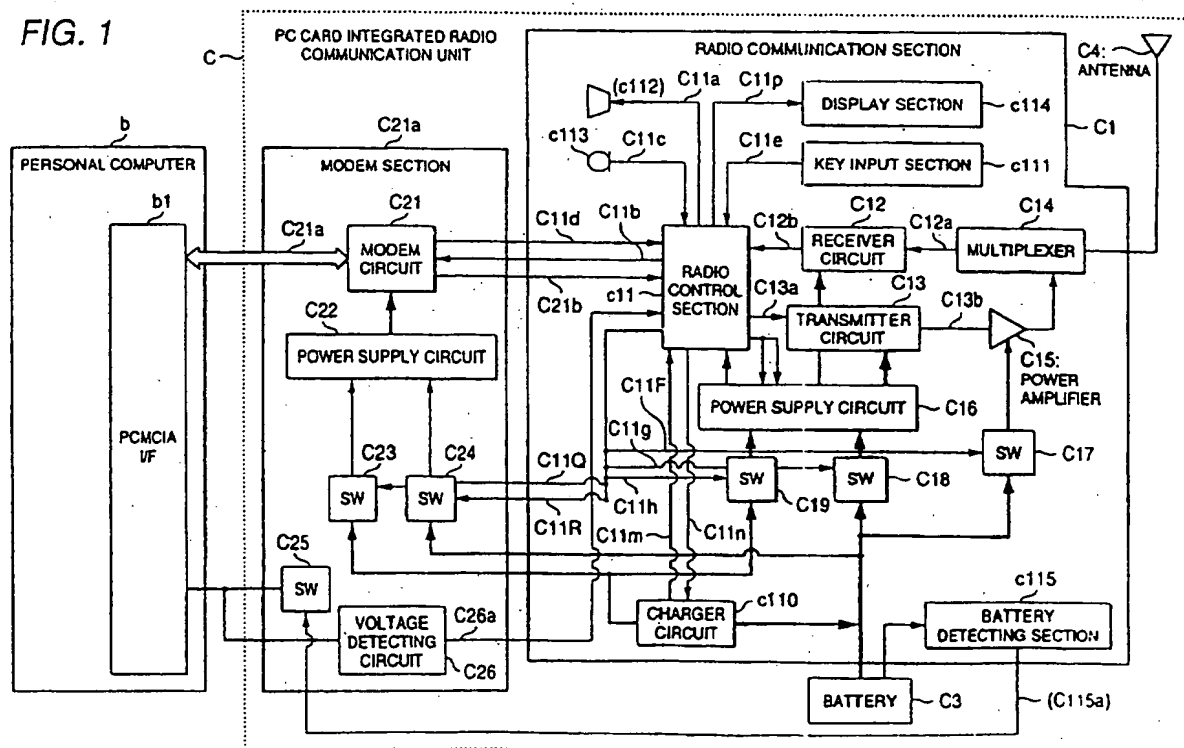


FIG. 1

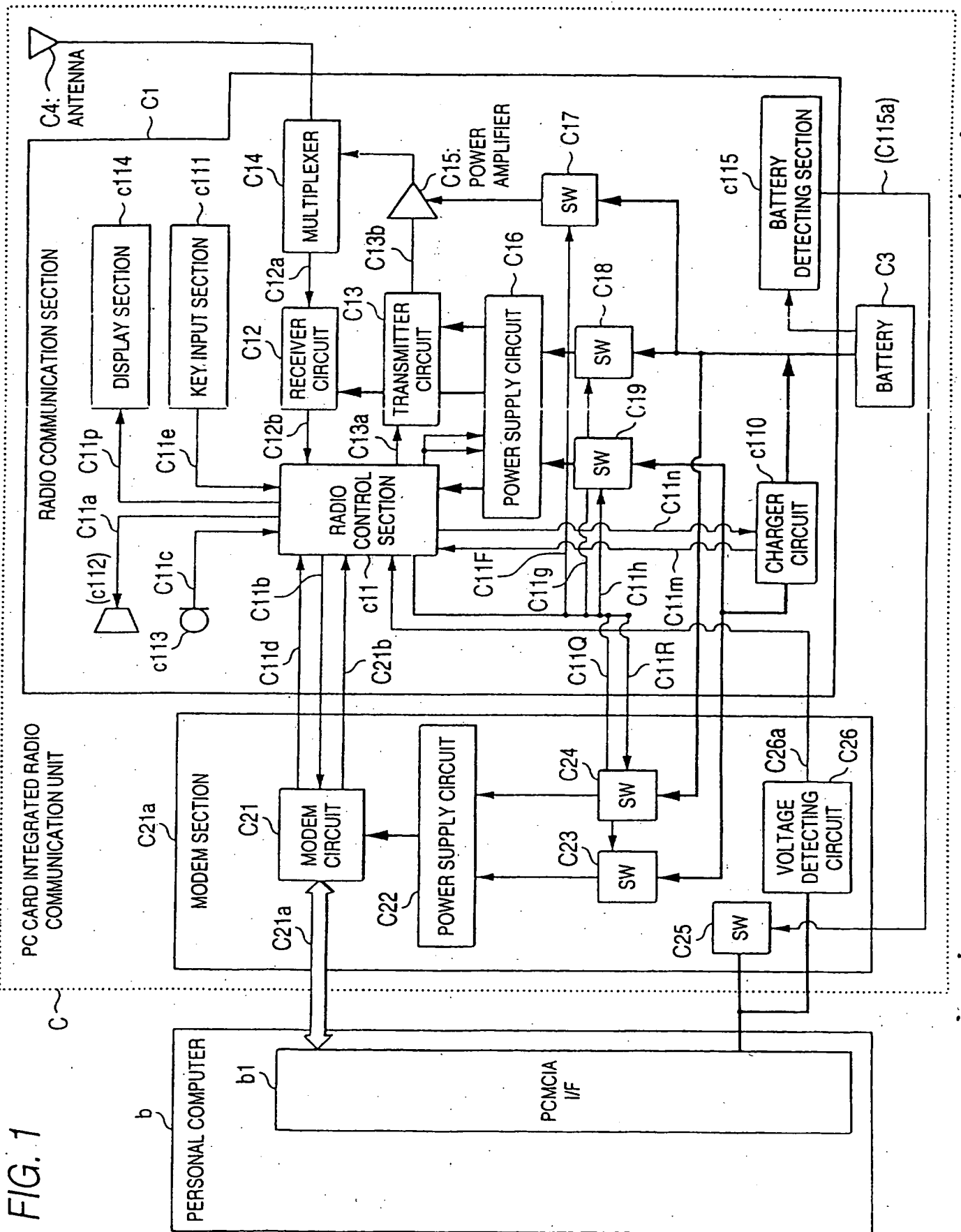


FIG. 2

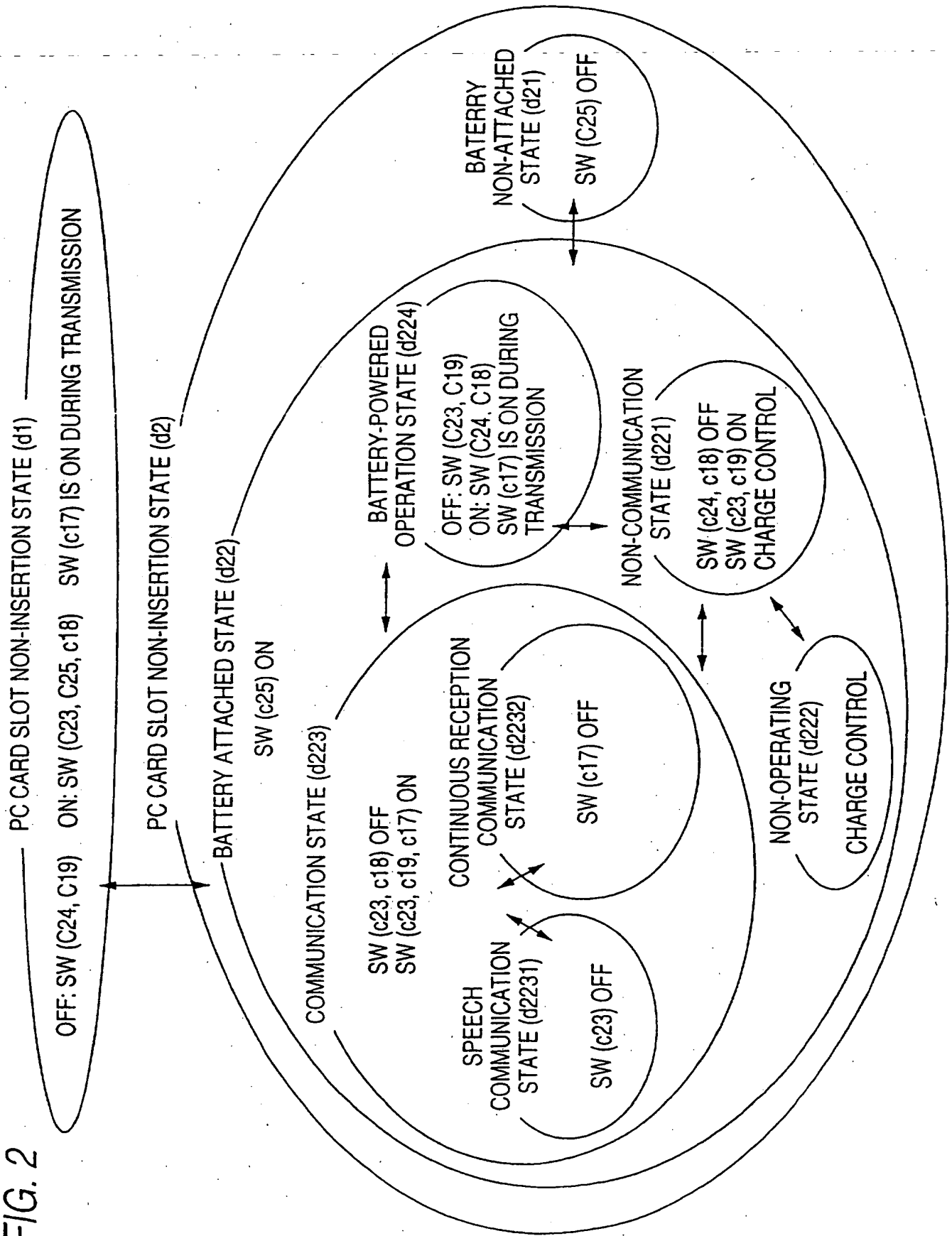
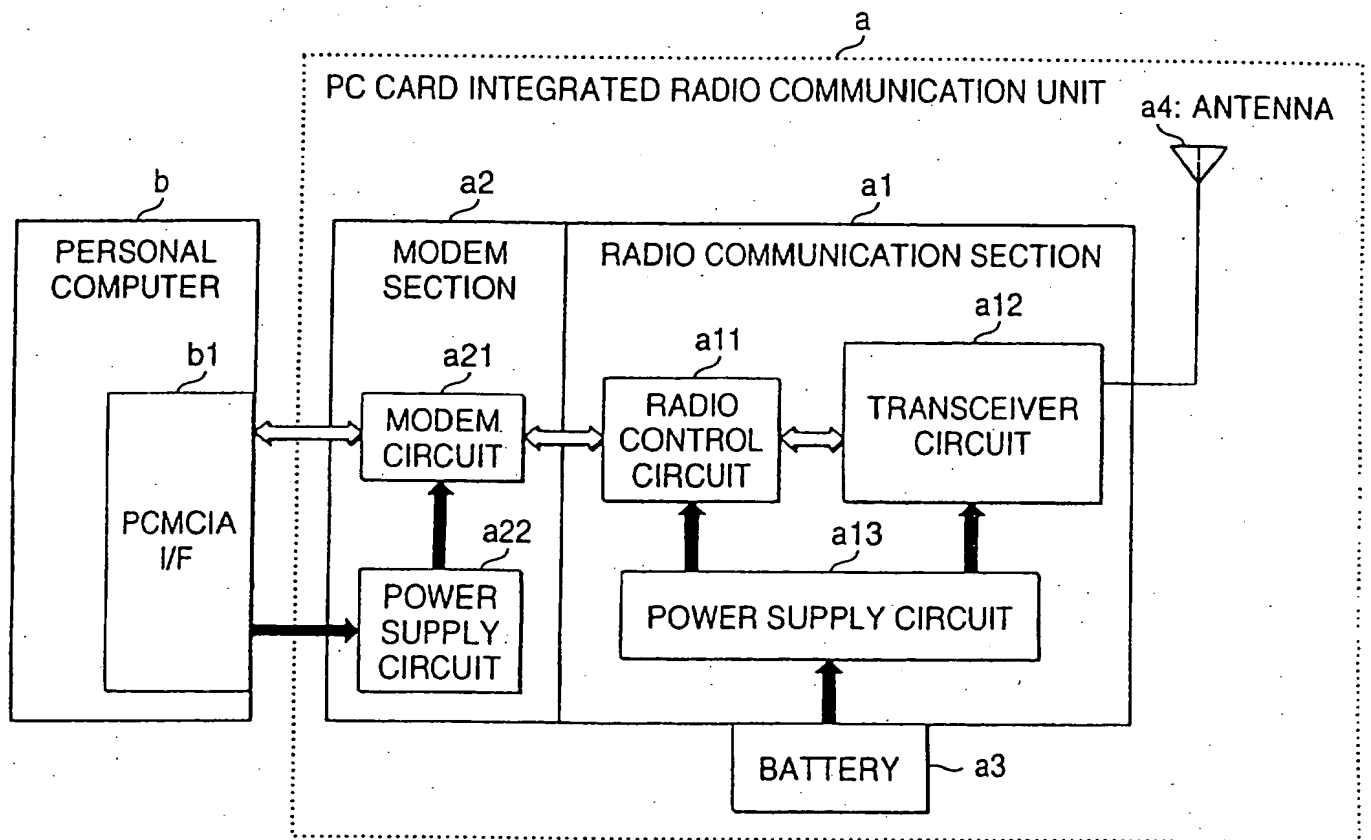


FIG. 3



PC CARD INTEGRATED RADIO COMMUNICATION APPARATUS

The present invention relates to PC card integrated radio
5 communication terminal apparatus which has integrated a radio
communication unit such as a portable telephone set and a PC card
type modem. The invention is contemplated, particularly for
power supply from a PC card slot and power supply from a battery,
to control power distribution to each section of the apparatus
10 and to control battery charge.

Radio communication terminal apparatus which has
integrated a PC card type modem and a radio communication unit,
as known from JP-A-8-340389, is adapted to be used as a portable
telephone set when separately used as a terminal, and to be used
15 as data communication terminal apparatus when the apparatus is
connected via a personal computer and the PCMCIA interface (I/F).

Fig. 3 shows the configuration of a conventional PC card
integrated radio communication apparatus (a). The conventional
PC card integrated radio communication apparatus (a) is composed
20 of a modem section (a2), a radio communication section (a1), a
battery (a3), and an antenna (a4).

The radio communication section (a1) is composed of a
radio control circuit (a11), a transceiver circuit (a12), and a
power supply circuit (a13).

The modem section is composed of a modem circuit (a21) and a power supply circuit (a22).

It is contemplated that the voltage of the battery (a3) is supplied to the radio communication section (a1) alone and not
5 to the modem section (a2).

It is contemplated that the voltage is supplied from the power supply terminal of the PCMCIA slot (b1) to the modem section (a2) alone and not to the radio communication section (a1) in a state where the PC card integrated radio communication unit (a)
10 is inserted in the PCMCIA slot (b1) of the personal computer (b).

As mentioned above, conventional PC card integrated radio communication apparatus can use a battery alone for power supply to the radio communication section, in a state where the apparatus is attached to a personal computer. Thus the service hour of
15 the PC card integrated radio communication apparatus is determined by the discharge capacity of the battery.

In conventional PC card integrated radio communication apparatus, the power supply circuit was simplified so that the battery was dedicated for the radio communication section and the
20 power for the PC card slot was dedicated for the modem section.

Thus no voltage is supplied from the PC card slot of a personal computer and service hour of the apparatus cannot be prolonged.

The invention, concerning the above problems, aims at providing PC card integrated radio communication apparatus wherein service hour is prolonged and battery charge is made possible in the operating state where current consumption of the radio communication section is small, by controlling power distribution to each section of the apparatus and to control battery charge for power supply from a PC card slot and power supply from a battery, depending on the power supply state of the personal computer and operating state of the apparatus.

To solve the problems, as described in the first aspect of the invention, PC card integrated radio communication apparatus is devised, having a battery, a radio communication section and a modem section integrated into a PC card, in that the apparatus is equipped with insertion/non-insertion state detection means for detecting the insertion/non-insertion state of the radio apparatus into a PC card slot; power supply mode selection/power supply means for selecting the power supply mode of the power supply from the battery and/or power supply from the PC card slot depending on the insertion/non-insertion state and the connection state of the radio communication device including attachment of the battery and the operating states of the radio communication section and the modem section to supply power; and charge means for recharging the battery via power supply from the

PC card slot, after checking the state of the radio communication section while the insertion/non-insertion state detection means is detecting the insertion state, wherein service hour is prolonged and battery charge is made possible in the operating
5 state where current consumption of the radio communication section is small, by controlling power distribution to each section of the apparatus or to control battery charge for power supply from a PC card slot and power supply from a battery, depending on the power supply state of the personal computer and
10 operating state of the apparatus.

As described in the second aspect of the invention, PC card integrated radio communication apparatus according to the first aspect of the invention is devised, in that the power supply mode selection/power supply means shuts off power supply from the
15 battery to the modem section while the insertion/non-insertion state detection means is detecting the non-insertion state, wherein power supply to the modem section is shut off to reduce current consumption in the apparatus in a state where the PC card integrated radio communication apparatus is not attached to the
20 PC card slot.

As described in the third aspect of the invention, PC card integrated radio communication apparatus according to the first aspect of the invention is devised, in that the power supply mode selection/power supply means supplies power to the modem section

and radio communication section from the PC card slot as well as
shuts off power supply from the battery while the
insertion/non-insertion state detection means is detecting the
insertion state and the radio communication section is in the
5 non-communication state, wherein power supply from the PC card
slot is capable of supplying power to operate the PC card
integrated radio communication apparatus in a state where the
current consumption of the radio communications section is small,
such as the non-communication state, and wherein battery
10 discharge can be prevented and apparatus operation can be
maintained by supplying power from the PC card slot to the modem
section and radio communication section of the PC card integrated
radio communication apparatus as well as shutting off power supply
from the battery.

15 As described in the fourth aspect of the invention, PC
card integrated radio communication apparatus according to the
first aspect of the invention is devised, in that the apparatus
has means for detecting whether the battery is attached or not
and the power supply mode selection/power supply means shuts off
20 power supply from the PC card slot while the insertion/non-
insertion state detection means is detecting the insertion state
and the battery is removed, wherein the apparatus detects that
the battery is removed and deactivates the entire apparatus by
shutting off power supply from the PC card slot thus preventing

malfunction of the apparatus.

As described in the fifth aspect of the invention, PC card integrated radio communication apparatus according to the first aspect of the invention is devised, in that the power supply mode selection/power supply means supplies power from the PC card slot and the charge means recharges the battery while the insertion/non-insertion state detection means is detecting the insertion state and the radio communication section is in the non-operating state or non-communication state, wherein power supply from the PC card slot is capable of supplying power to operate the PC card integrated radio communication apparatus in a state where the current consumption of the radio communications section is small, such as the non-operating state before the apparatus is powered or non-communication state, and capable of recharging the battery with extra power.

As described in the sixth aspect of the invention, PC card integrated radio communication apparatus according to the first aspect of the invention is devised, in that the power supply mode selection/power supply means selects power supply from the PC card slot and the battery to supply power to the radio communication section while the insertion/non-insertion state detection means is detecting the insertion state and the radio communication section is in the communication state, wherein discharge current from the battery is reduced to prolong service hour of the

apparatus in a communication state where current consumption of the radio communication section is relatively large, by supplying power simultaneously from the PC card slot and the battery.

As described in the seventh aspect of the invention, PC
5 card integrated radio communication apparatus according to the first aspect of the invention is devised, in that the power supply mode selection/power supply means shuts off power supply to the modem section while the insertion/non-insertion state detection means is detecting the insertion state and the radio communication
10 section is in the speech communication state, wherein current consumption of the apparatus can be reduced by shutting off power supply to the modem section because conversation is possible via the radio communication section alone in the speech communication state.

15 As described in the eighth aspect of the invention, PC card integrated radio communication apparatus according to the first aspect of the invention is devised, in that the power supply mode selection/power supply means supplies power to the modem section and radio communication section from the battery as well
20 as shuts off power supply from the PC card slot while the insertion/non-insertion state detection means is detecting the insertion state and in case where a control signal or command is given to the power supply mode selection/power supply means from a personal computer connected via the PC card slot, wherein current

consumption of the personal computer is reduced by supplying power to the modem section also from the battery in the apparatus in a state where the personal computer is operating from the battery built into the personal computer alone and the battery built into the personal computer is weak, thus prolonging the service hour in total.

As described in the ninth aspect of the invention, PC card integrated radio communication apparatus according to the first aspect of the invention is devised, in that the power supply mode selection/power supply means supplies power to the modem section and radio communication section from the PC card slot as well as shuts off power supply from the battery while the insertion/non-insertion state detection means is detecting the insertion state and the radio communication section is in the continuous reception state, wherein the power supply does not require a large current supply capability because no transmission is made in the continuous reception state during packet communication, and the apparatus is operable from power supply from the PC card alone in this state thus communication can be maintained without power supply from the battery.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows the circuit configuration of the PC card integrated radio communication apparatus according to embodiments of the invention;

Fig. 2 is the state transition diagram which shows transition of the operating state of the PC card integrated radio communication apparatus; and

Fig. 3 shows the configuration of conventional apparatus.

5

Embodiments of the invention are explained below by using Fig. 1 and Fig. 2.

The PC card integrated radio communication apparatus according to embodiments of the invention can select power supply to each section of the apparatus from among three power supply modes: "power supply from PC card slot," "power supply from battery," and "simultaneous power supply from PC card slot and battery." When the radio communication section (C1) is in the non-communication state, the apparatus can shut off "power supply from battery" and use "power supply from PC card slot" alone and can recharge the battery via "power supply from PC card slot."

When the radio communication section is in the communication state, the apparatus can operate from "simultaneous power supply from PC card slot and battery." Further, when the radio communication section is in the speech communication state, the apparatus can shut off power supply to the modem section.

Moreover, when the battery is removed, the apparatus can shut off "power supply from PC card slot." The apparatus, receiving an instruction from a personal computer while in operation, can

switch the power supply to each section of the apparatus from "power supply from PC card slot" or "simultaneous power supply from PC card slot and battery" to "power supply from battery."

The PC card integrated radio communication apparatus is adapted to shut off power supply from the battery to the modem section in the state where the radio communication apparatus is not inserted in the PC card slot.

Thus, a feature of selecting the power supply mode from power supply from battery and/or PC card slot to supply power depending on the connection state of the PC card integrated radio communication apparatus and operating state of the radio communication section and the modem section is called a "power supply mode selection/power supply means."

Fig. 1 shows the circuit configuration of the PC card integrated radio communication unit (C) according to embodiments of the invention. In one embodiment, PC card integrated radio communication unit (C) is electrically and physically connected to a personal computer (b) via PCMCIA I/F (b1) and used as data communication apparatus. In another embodiment, PC card integrated radio communication unit (C) is used separately as a portable telephone set.

The PC card integrated radio communication unit (C) is composed of a radio communication section (C1), a modem section (C2), a battery (C3), and an antenna (C4)

The radio communication section (C1) is composed of a radio control circuit (C11), a receiver circuit (C12), a transmitter circuit (C13), a multiplexer (C14), a power amplifier (C15), a power supply circuit (C16), a switch circuit (C17), a switch circuit (C18), a switch circuit (C19), a charger circuit (C110), a key input section (C111), a receiver (C112), a microphone (C113), and a display section (C114).

The radio control circuit (C11) is composed of a microprocessor, a memory, an input/output circuit, and a speech processing circuit, none of which are shown, and controls the entire PC card integrated radio communication unit (C).

The PC card integrated radio communication unit (C) communicates via the PDC system. The radio control circuit (C11) controls the radio communication procedures of the PDC system to realize communications. The radio communication procedures of the PDC system is well known and will not be detailed.

The receiver circuit (C12) detects a receive high-frequency signal (c12a) received via the multiplexer (C14) from the antenna (C4) then demodulates the high-frequency signal (c12a) to a digital signal. In case where demodulated digital data (c12b) is a sound signal, sound decoding processing is performed by the speech processing circuit in the radio control circuit (C11), then converted to a receive analog sound signal (c11a) and sent to the receiver (C112). In case where demodulated

digital data (c12b) is a non-sound signal, the data is sent to the modem circuit (C21) as a receive non-sound signal (c11b).

The transmit analog sound signal (c11c) is converted to a digital sound signal by the speech processing circuit in the radio control circuit (C11), then sent to the transmitter circuit (C13) as a transmit digital signal (c13a). The transmit non-sound signal (c11d) is sent to the transmitter circuit (C13) via the radio control circuit (C11) as a transmit digital signal (c13a).

10 The transmitter circuit (C13) converts the transmit digital signal (c13a) to a transmit high-frequency signal (c13b) and sends the transmit high-frequency signal (c13b) to the power amplifier (C15). The power amplifier (C15) amplifies the transmit high-frequency signal (c13b) to a predetermined power and sends the resulting signal via the multiplexer (C14) and the antenna (C4).

The power supply circuit (C16) is a circuit which supplies a stable constant voltage to the receiver circuit (C12) and the transmitter circuit (C13). The switch circuit (C17) is a circuit for supplying or shutting down the power of the battery (C3) to the power amplifier (C15). The switch circuit (C19) is a circuit for supplying or shutting down the power from the PCMCIA I/F (b1) to the power supply circuit (C16).

20 These switch circuits (C17, C18, C19) are controlled to

open or close by the radio control circuit (C11) via respective switch control signals (c11f, c11g, c11h). The switch circuit (C17) is controlled to stay on during transmission alone so that power consumption during non-transmission interval is reduced.

5 The charger circuit (C110) is a circuit for recharging a battery with constant voltage and constant current by converting the power from the PCMCIA I/F (b1) to a constant-voltage and constant-current power then supplies the resulting power to the battery (C3). The supply current capability of the charger
10 circuit (C110) is set to a current value which does not exceed the current supply capability of the PCMCIA I/F (b1). Start and stop of charge is controlled via a charge control signal by the radio control circuit (C11). The charger circuit (C110), on detecting a charge end current use as completion conditions for
15 constant-voltage, constant-current charge, sends a charge end detection signal (c11m) to the radio control circuit (C11).

 The radio control circuit (C11), based on the input information entered from the key input section (C111), sends the display information (c11p) to the display section (C114) for
20 display of miscellaneous information.

 The battery detecting section (C115) has a feature of detecting whether a battery (C3) is attached or not. The battery detecting section (C115) is composed of a microswitch and sends a detection signal (c115a).

The modem section (C2) has a feature of coding/decoding non-sound data received at the radio communication section (C1) or non-sound data sent from the PCMCIA I/F (b1) of a personal computer, based on the MNP standard.

5 The modem section (C2) is composed of a modem circuit (C21), a power supply circuit (C22), a switch circuit (C23), a switch circuit (C24), a switch circuit (C25), and a voltage detecting circuit (C26). The modem circuit (C21) is composed of a microcomputer, a memory, and an input/output circuit, none of
10 which are shown, and has a feature of coding/decoding non-sound data based on the MNP standard and sending/receiving data between the personal computer (b) and the radio communication section (C1).

 The modem circuit (C21) sends/receives non-sound data
15 to/from the personal computer and receives modem control data and control data of the radio communication section (C1) from the personal computer via the PCMCIA I/F (b1) bus. The modem circuit (C21) sends the control data of the radio communication section (C1) received from the personal computer to the radio control
20 circuit (C11) via a control signal (c21b). The power supply circuit (C22) is a circuit for supplying a stable constant voltage to the modem circuit (C21).

 The switch circuit (C24) is a circuit for supplying/shutting off the power of the battery (C3) to the power

supply circuit (C22). The switch circuit (C23) is a circuit for supplying/shutting off the power from the PCMCIA I/F (b1) to the power supply circuit (C22). These switch circuits (C23, C24) are controlled to open or close by the radio control circuit (C11) via respective switch control signals (c11Q, c11R).

The switch circuit (C25) is a circuit for supplying/shutting off the power from the PCMCIA I/F (b1) to the modem section (C2) and the radio communication section (C1). The switch circuit (C25) is controlled by the detection signal (c115a) of the battery detecting section (C115) and is turned off in the state where the battery (C3) is removed and turned on in the state where the battery (C3) is attached.

The voltage detecting circuit (C26) is a circuit for detecting whether the PC card integrated radio communication unit (C) of the invention has been inserted in the PCMCIA I/F (b1) slot.

When this is the case, the voltage detecting circuit (C26) detects the supplied voltage and notifies, via an insertion detecting signal (c26a), the radio control circuit (C11) whether the apparatus main unit is inserted or not inserted.

Operation of the PC card integrated radio communication unit (C) of the invention is explained below by using the operating state transition diagram in Fig. 2.

In case where the radio control circuit has recognized that the apparatus (C) is in the non-insertion state via the

insertion detecting signal (c26a), the apparatus (C) makes transition to the PC card slot non-insertion state (d1). In this state, the radio control circuit (C11) makes control to supply power to necessary sections alone by turning off switch circuits (C24, C19) and supplying the power of the battery (C3) to the radio communication section (C1) alone, as well as supply the power from the PCMCIA I/F (b1) to the modem section (C2) in case where the apparatus is inserted in the PCMCIA I/F (b1) slot.

In case where the radio control circuit has recognized that the apparatus (C) is in the insertion state via the insertion detecting signal (c26a), the apparatus (C) makes transition to the PC card slot insertion state (d2). In case where the battery (C3) is removed in this state, the apparatus (C) makes transition to the battery non-attached state (d21). In this state, on detection of removal of the battery (C3) by the battery detecting section (C115), control is made to turn off the switch circuit (C25) and shut off all power supply to the PC card integrated radio communication unit. Thus the apparatus is inoperable in the state where the battery is removed. This prevents malfunction due to sending operation using power supply from the PCMCIA I/F (b1) alone, or malfunction of the personal computer (b) due to large current during sending operation.

In case where the battery (C3) is attached in the PC card slot insertion state (d2), the apparatus (C) makes transition to

the battery attached state (d22). In this state, control is made by the battery detecting section (C115) to turn on the switch circuit (C25) thus allowing power supply from the PCMCIA I/F (b1).

The apparatus stays inoperable, i.e., stays in the non-operating state (d222) even when the battery (C3) is just attached. The apparatus makes transition to the non-communication state (d221) when the power switch (not shown) associated with the key input section is turned on. The apparatus returns to the non-operating state (d222) when the power switch is turned off.

10 When the apparatus is powered via the power switch, the radio control circuit (C11) performs awaiting operation or out-of-the-coverage awaiting operation via the PDC system communication control means to place the apparatus in the non-communication state (d221). The radio control circuit (C11)
15 makes control to turn off switch circuits (C24, C18) and turn on switch circuits (C23, C19). In this way, the radio control circuit (C11) can save current consumption of the battery by supplying power from the PCMCIA I/F (b1) alone in the non-communication state where current consumption of the apparatus
20 is small.

The radio control circuit (C11) performs charge control of the battery (C3) via the charger circuit (C110) in the non-communication state (d221) or non-operating state (d222).

In this way, the radio control circuit (C11) recharges the battery

(C3) via power supply from the PCMCIA I/F (b1) in the non-communication state or non-operating state (d222) where current consumption of the apparatus is small.

5 In case where the apparatus has made transition from the non-communication state (d221) or non-operating state (d222) to another state, the radio control circuit (C11) controls the charger circuit (C110) so that charge operation is immediately halted.

10 This apparatus, on call origination via key input or call termination from the network, makes transition to the communication state (d223). The radio control circuit (C11) makes control to turn off switch circuits (C24, C18) and turn on switch circuits (C23, C19, C17). In this way, the apparatus receives power supply simultaneously from the battery (C3) and
15 the PCMCIA I/F (b1).

In case where the apparatus is in the communication state (d223) and communication data is sound data, the radio communication section (C11) is placed in the speech communication state (d2231) and makes control to turn off the switch circuit
20 (C23). In this way, it is contemplated to shut off power supply to the modem section (C2) which need not operate in speech communications.

Further, the apparatus may be placed in the continuous reception communication state (d2232) where continuous reception

is performed and transmission is not performed, such as a state where high-capacity files are continuously downloaded. In this state, the radio control circuit (C11) makes control to turn off the switch circuit (C17) to shut down power supply from the battery
5 (C3) and operates on power supply from the PCMCIA I/F (b1) alone.

In case where the radio control circuit (C11) has received a battery-powered operation instruction via the PCMCIA I/F (b1), bus (c21a), modem circuit (C21) and control signal (c21b), the apparatus makes transition to the battery-powered operation state
10 (d224). In this state, the radio control circuit (C11) makes control to turn off switch circuits (C23, C19) and turn on switch circuits (C24, C18). In this way, the radio control circuit (C11) shuts off power supply from the PCMCIA I/F (b1) and supplies power from the battery (C3) to the radio communication section and the
15 modem section (c2).

Thus, in embodiments of the invention, a circuit configuration is contemplated wherein power source for respective power circuits of the radio communication section and the modem section can be selected from the PC card slot of a personal computer
20 or a battery, or both of them simultaneously. This allows selection of the optimum power supply mode depending on the connection mode and operating state of the apparatus.

In case where a personal computer is operated from commercial power, for example via an AC adapter, power supply from

the PC card slot can be semi-permanently received. Thus the battery in the apparatus can be recharged by extra power in an operating state where current consumption of the radio communication section is small.

5 On the other hand, current consumption of the personal computer is reduced by supplying power to the modem section also from the battery in the apparatus in an operating state where the personal computer is operating from the battery built into the personal computer alone and the battery built into the personal
10 computer is weak, thus prolonging the service hour in total.

 Thus, according to the invention, PC card integrated radio communication apparatus is devised, having a battery, a radio communication section and a modem section integrated into a PC card, characterized in that the apparatus is equipped with
15 insertion/non-insertion state detection means for detecting the insertion/non-insertion state of the radio apparatus into a PC card slot; power supply mode selection/power supply means for selecting the power supply mode of the power supply from the battery and/or power supply from the PC card slot depending on
20 the insertion/non-insertion state and the connection state of the radio communication device including attachment of the battery and the operating states of the radio communication section and the modem section to supply power; and charge means for recharging the battery via power supply from the PC card slot, after checking

the state of the radio communication section while the insertion/non-insertion state detection means is detecting the insertion state. Thus an advantage is obtained that service hour is prolonged and battery charge is made possible in the operating state where current consumption of the radio communication section is small, by controlling power distribution to each section of the apparatus or to control battery charge for power supply from a PC card slot and power supply from a battery, depending on the power supply state of the personal computer and operating state of the apparatus.

Another advantage is obtained that power supply to the modem section is shut off to reduce power consumption in the modem section in a state where the apparatus is not inserted in the PC card slot.

Another advantage is obtained that, in a state where the apparatus is inserted in the PC card slot and the radio communication section is in the non-communication state, battery discharge can be prevented and apparatus operation can be maintained by supplying power from the PC card slot to the modem section and radio communication section as well as shutting off power supply from the battery.

Another advantage is obtained that, the entire apparatus is deactivated and malfunction of the apparatus is prevented by providing means for detecting insertion/non-insertion of the

battery and shutting off power supply from the PC card slot in a state where the apparatus is inserted in the PC card slot and the battery is removed.

Another advantage is obtained that, in a state where the apparatus is inserted in the PC card slot and the radio communication section is in the non-operating state or non-communication state, operation of the apparatus is maintained and the battery is recharged with extra power in a state where the current consumption of the radio communications section is small, such as the non-operating state before the apparatus is powered or non-communication state, by recharging the battery with power supply from the PC card slot.

Another advantage is obtained that, in a state where the apparatus is inserted in the PC card slot and the radio communication section is in the non-operating state or non-communication state, discharge current from the battery is reduced to prolong service hour of the apparatus in a communication state where current consumption of the radio communication section is relatively large, by supplying power simultaneously from the PC card slot and the battery to operate the apparatus.

Another advantage is obtained that, in a state where the apparatus is inserted in the PC card slot and the radio communication section is in the speech communication state, power consumption of the apparatus reduced by the power consumption of

the modem section, by shutting off power supply to the modem section.

Another advantage is obtained that, in a state where the apparatus is inserted in the PC card slot, current consumption
5 of the personal computer is reduced, via a control signal or a command from a personal computer, by supplying power to the modem section and the radio communication section from the battery as well as shutting off power supply from the PC card slot in a state where the personal computer is operating from the battery built
10 into the personal computer alone and the battery built into the personal computer is weak, thus prolonging the service hour in total.

Another advantage is obtained that, in a state where the apparatus is inserted in the PC card slot and the radio
15 communication section is in the continuous reception state, signal operation can be maintained without power supply from the battery in a continuous reception state such as packet communications, by supplying power to the modem section and radio communication section from the PC card slot as well as shutting
20 off power supply from the battery.

CLAIMS

1. PC card integrated radio communication apparatus comprising:

a battery;

5 a radio communication section;

a modem section integrated into a PC card;

insertion/non-insertion state detection means for detecting the insertion/non-insertion state of said radio apparatus into a PC card slot;

10 power supply mode selection/power supply means for selecting the power supply mode of the power supply from said battery and/or power supply from said PC card slot depending on said insertion/non-insertion state and the connection state of said radio communication device including attachment of said
15 battery and said operating states of said radio communication section and said modem section to supply power; and

charge means for recharging said battery via power supply from said PC card slot, after checking the state of said radio communication section while said insertion/non-insertion state
20 detection means is detecting the insertion state.

2. PC card integrated radio communication apparatus according to Claim 1, wherein said power supply mode selection/power supply means shuts off power supply from said

battery to said modem section while said insertion/non-insertion state detection means is detecting the non-insertion state.

3. PC card integrated radio communication apparatus
5 according to Claim 1, wherein said power supply mode selection/power supply means supplies power to said modem section and said radio communication section from said PC card slot as well as shuts off power supply from said battery while said insertion/non-insertion state detection means is detecting the
10 insertion state and said radio communication section is in the non-communication state.

4. PC card integrated radio communication apparatus according to Claim 1, wherein said apparatus has means for
15 detecting whether said battery is attached or not and said power supply mode selection/power supply means shuts off power supply from said PC card slot while said insertion/non-insertion state detection means is detecting the insertion state and said battery is removed.

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5. PC card integrated radio communication apparatus according to Claim 1, wherein said power supply mode selection/power supply means supplies power from said PC card slot and said charge means recharges said battery while said

insertion/non-insertion state detection means is detecting the insertion state and said radio communication section is in the non-operating state or non-communication state.

5 6. PC card integrated radio communication apparatus according to Claim 1, wherein said power supply mode selection/power supply means selects power supply from said PC card slot and said battery to supply power to said radio communication section while said insertion/non-insertion state
10 detection means is detecting the insertion state and said radio communication section is in the communication state.

 7. PC card integrated radio communication apparatus according to Claim 1, wherein said power supply mode
15 selection/power supply means shuts off power supply to said modem section while said insertion/non-insertion state detection means is detecting the insertion state and said radio communication section is in the speech communication state.

20 8. PC card integrated radio communication apparatus according to Claim 1, wherein said power supply mode selection/power supply means supplies power to said modem section and radio communication section from said battery as well as shuts off power supply from said PC card slot while said

insertion/non-insertion state detection means is detecting the insertion state and in case where a control signal or command is given to said power supply mode selection/power supply means from a personal computer connected via said PC card slot.

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9. PC card integrated radio communication apparatus according to Claim 1, wherein said power supply mode selection/power supply means supplies power to said modem section and radio communication section from said PC card slot as well
10 as shuts off power supply from said battery while said insertion/non-insertion state detection means is detecting the insertion state and said radio communication section is in the continuous reception state.

10. A PC card integrated radio communication apparatus substantially as described with reference to the accompanying drawings.



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 Claims searched: 1 to 10

28. Examiner: Nik Dowell
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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
 UK Cl (Ed.S): H2H - HBCH H4L - LECTX
 Int Cl (Ed.7): G06F - 1/26, 1/28 H02J - 7/00 H04B - 1/38 H04M - 1/72 H04Q - 7/32
 Other: Online - WPI, EPODOC, PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2 325 119 A (NEC) page 4, line 17 - page 7, line 20	1 at least
X,P	EP 0 987 620 A1 (Fujitsu) column 2, lines 27 to 48	1 at least
X,P	WO 00/19364 A1 (Sierra Wireless) page 1, line 23 to page 2, line 15	1 at least
X	JP 100173802 A (Yazaki) WPI abstract Accession Number 98-420460/36	1
X,&	JP 090269851 A (Sharp) see US equivalent number 5969529	1,3,4,8
X,&	JP 090251063 A (Sharp) see US equivalent number 5969529	1,3,4,8
&	US 5 969 529 A (Sharp) see especially column 7, lines 3-23	1,3,4,8

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.